

Supervisory Control & Data Acquisition (SCADA) Systems



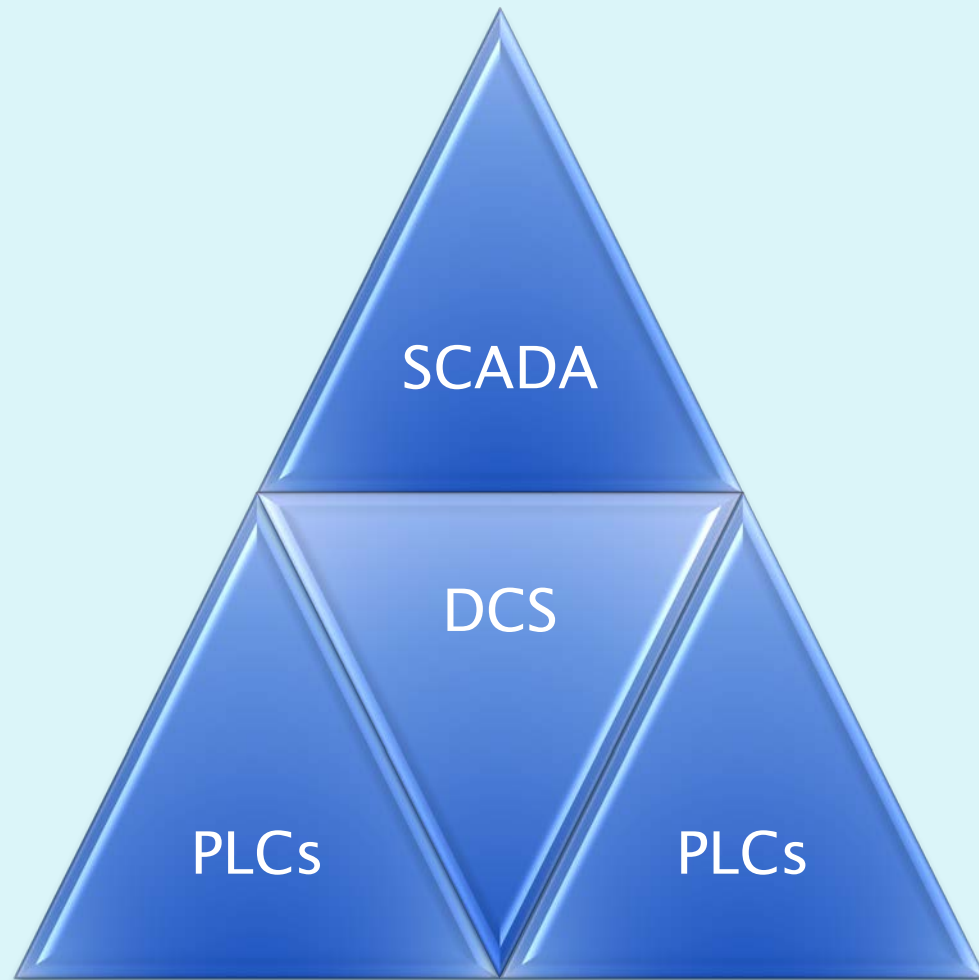
Overview of Industrial Control Systems

Industrial control system (ICS) are typically used in industries such as Electrical, Water, Oil and Gas, Chemical, Transportation, Pharmaceutical, Pulp and Paper, Food & Beverage and discrete manufacturing Industries such as Automobile, Aerospace, Durable Goods and essential services such as air traffic control and materials handling i.e. Postal Service mail handling etc.

Industrial control system (ICS) encompasses several types of control systems i.e.

- Programmable Logic Controllers (PLC).
- Distributed control systems (DCS) and
- Supervisory control and data acquisition (SCADA) systems

SCADA at the top level



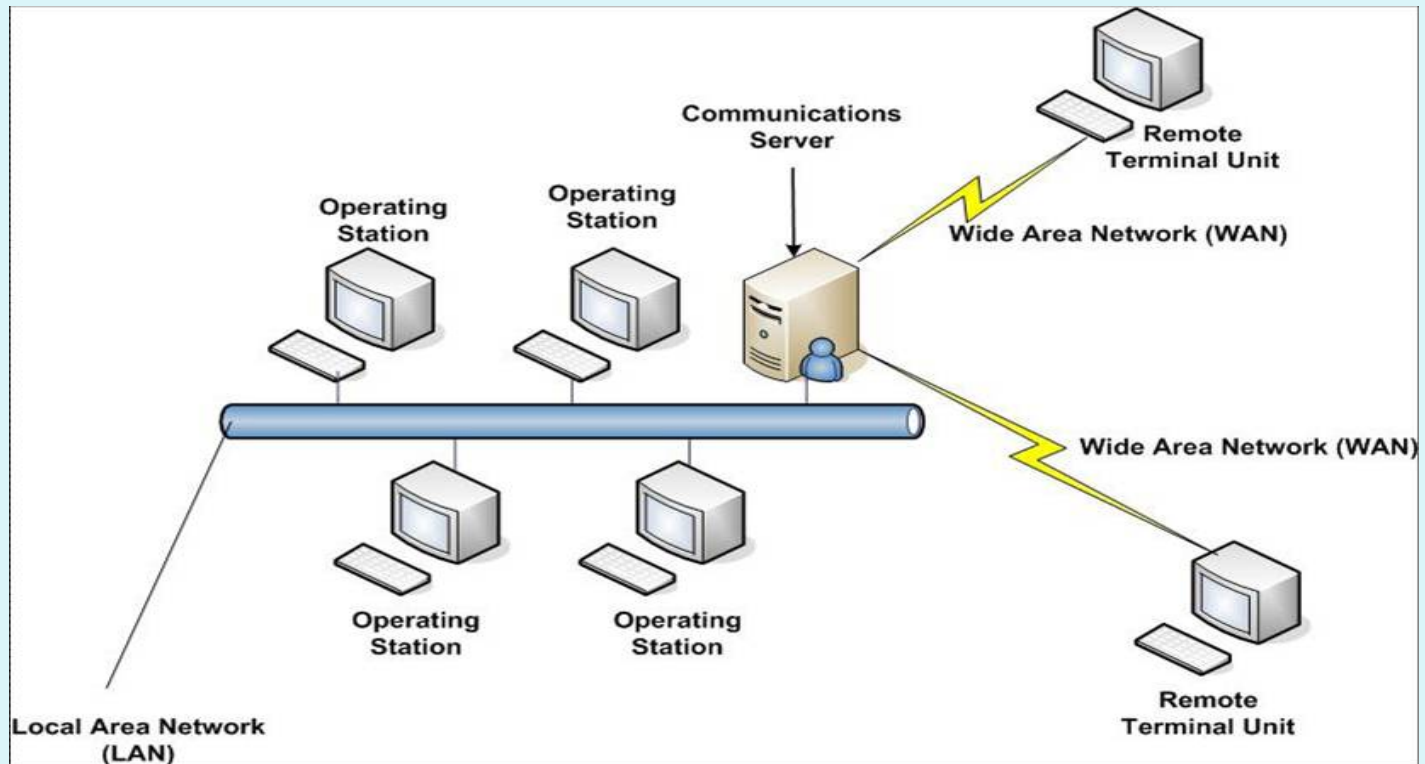
SCADA contd...

SCADA systems are used in industrial processes i.e. Steel Manufacturing, Power Generation & Distribution, Chemical Plants Processes etc. It also used in some experimental facilities such as nuclear fusion.

The size of such plants range from a few 1000 to several 10 thousands input/output channels. However, SCADA systems evolve rapidly and are now controls the plants with more than 100 K I/O channels and researches are going on to make it possible to control 1 M I/O channels.

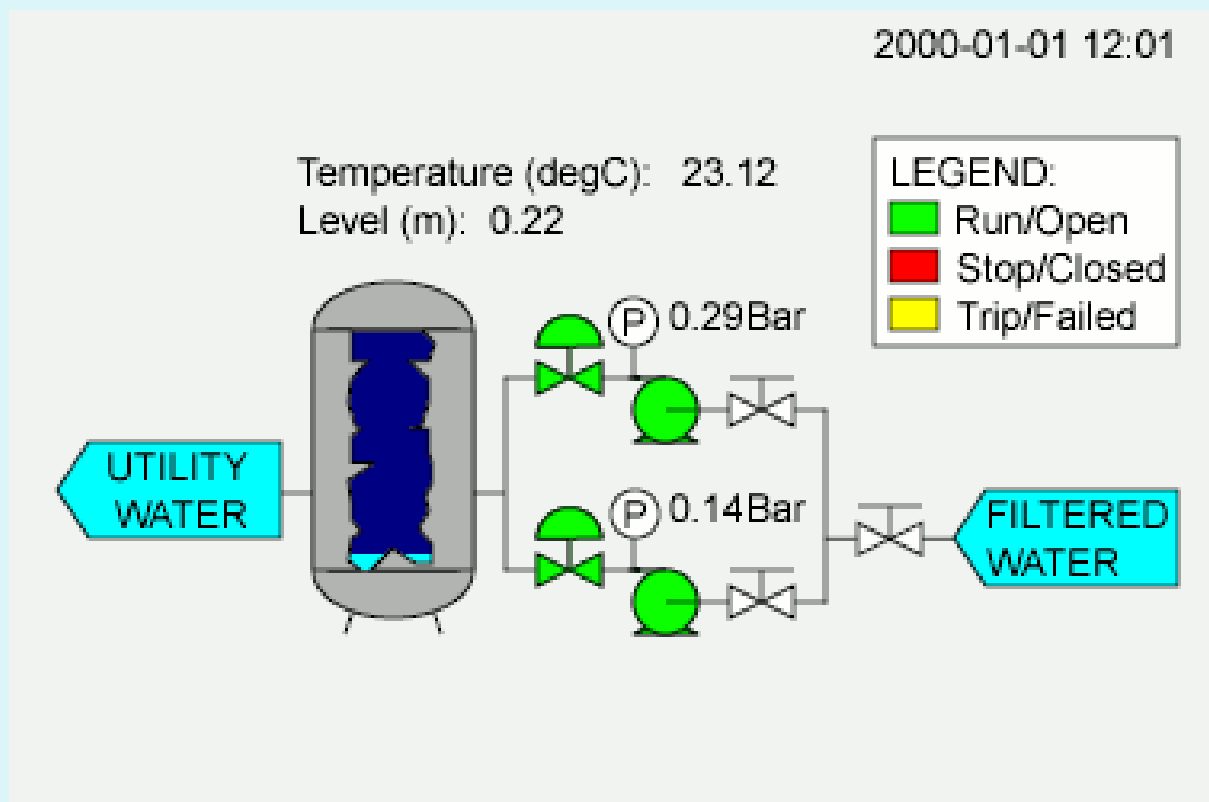
SCADA contd...

Field devices control local operations such as opening and closing valves and circuit breakers, collecting data from sensor systems, and monitoring the local environment for alarm conditions.



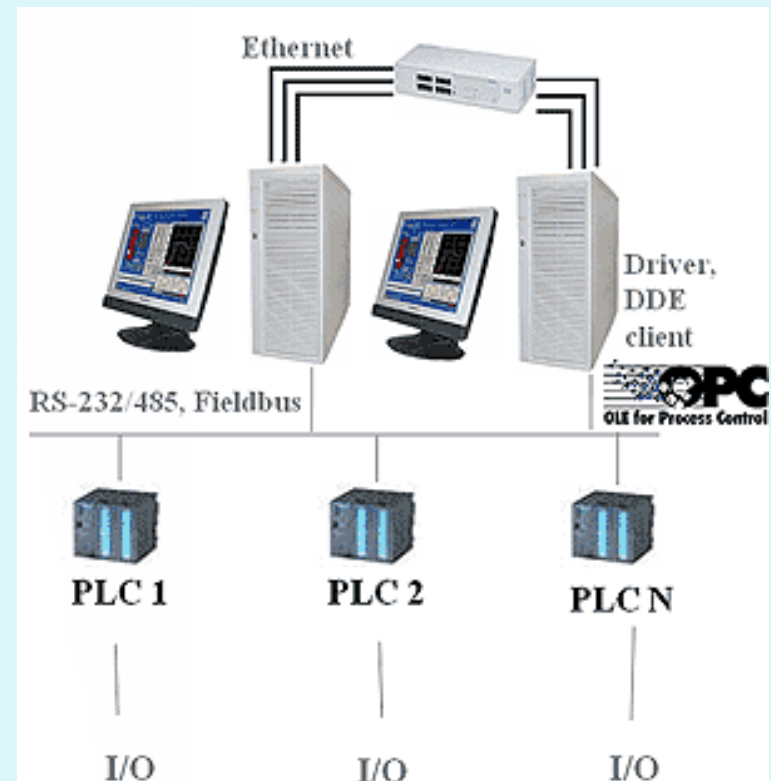
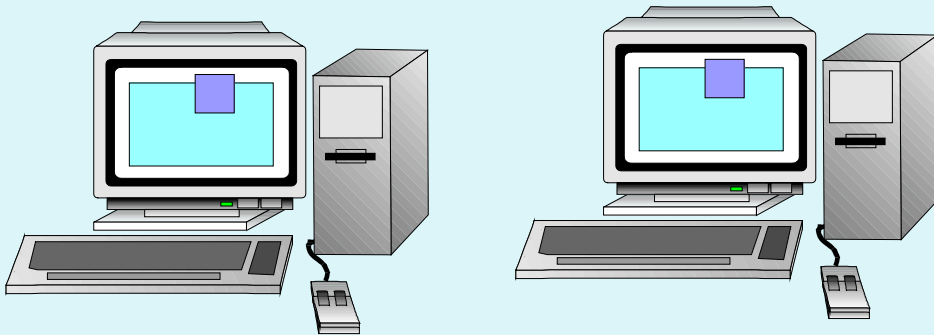
SCADA cont...

SCADA system allow the operators to change the set points for the flow, and enable alarm conditions, such as loss of flow and high temperature etc.

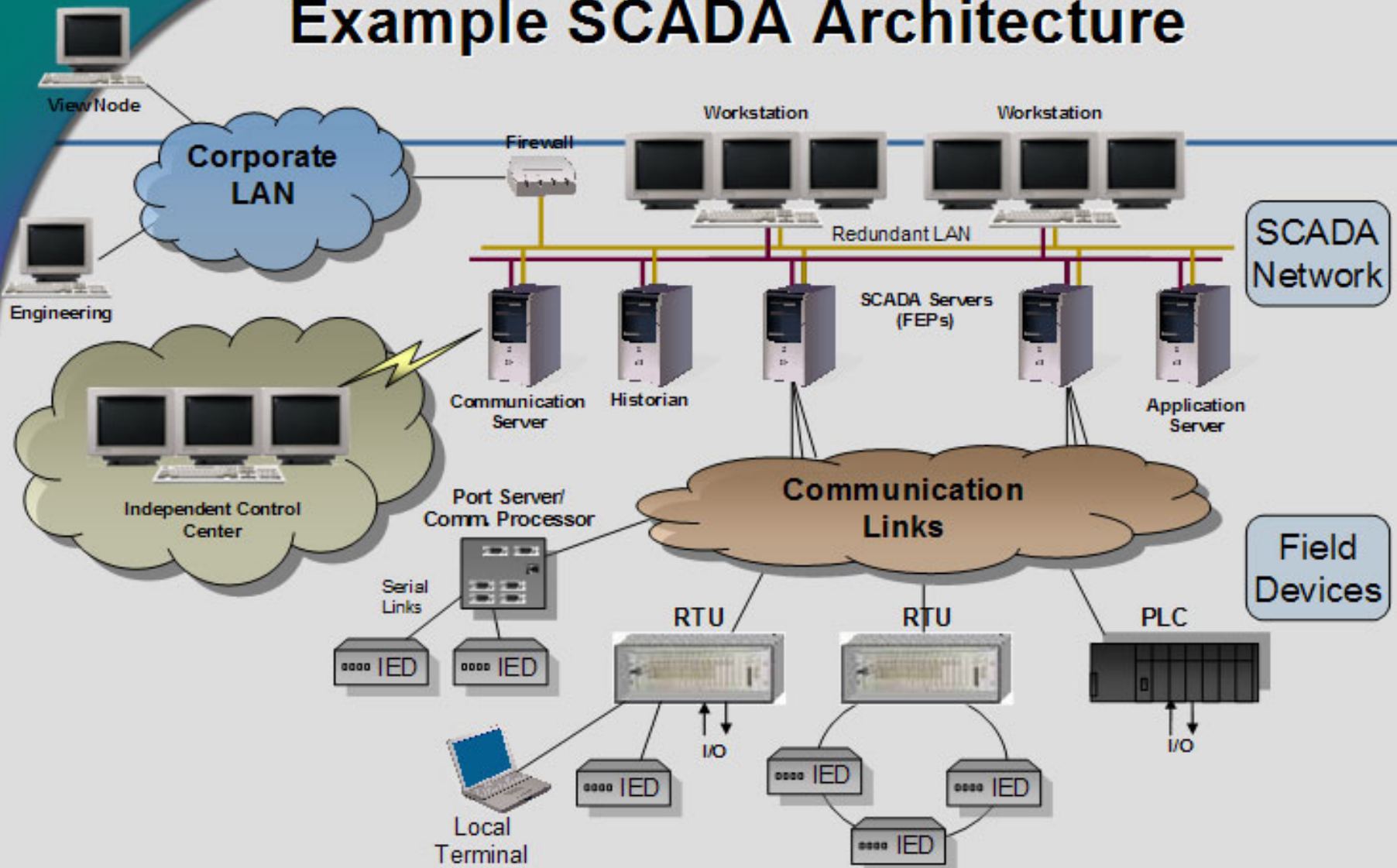


SCADA cont...

SCADA systems developed to run on DOS, VMS and UNIX, NT and Linux operating systems



Example SCADA Architecture



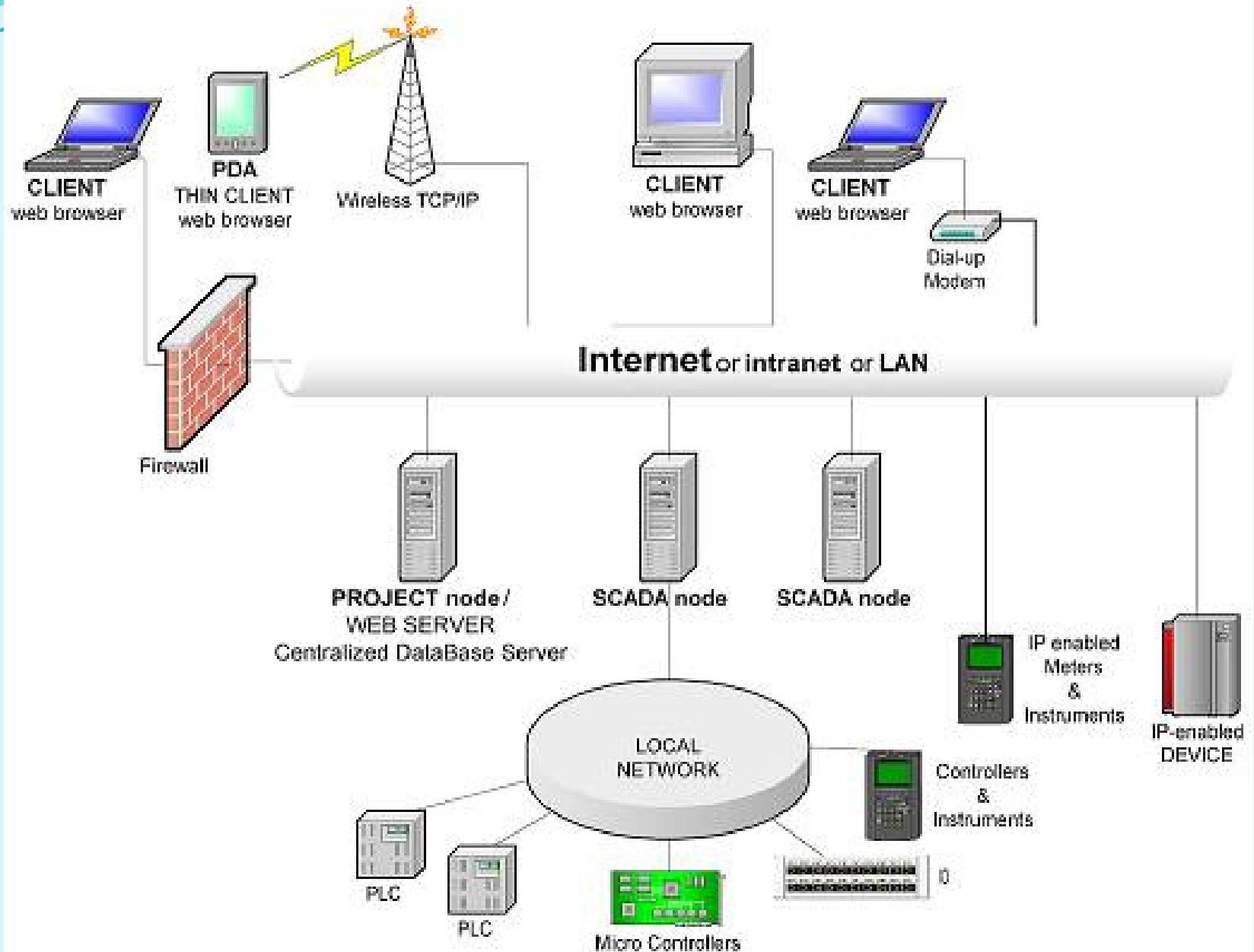
Hardware Architecture

SCADA has two basic layers in a system:

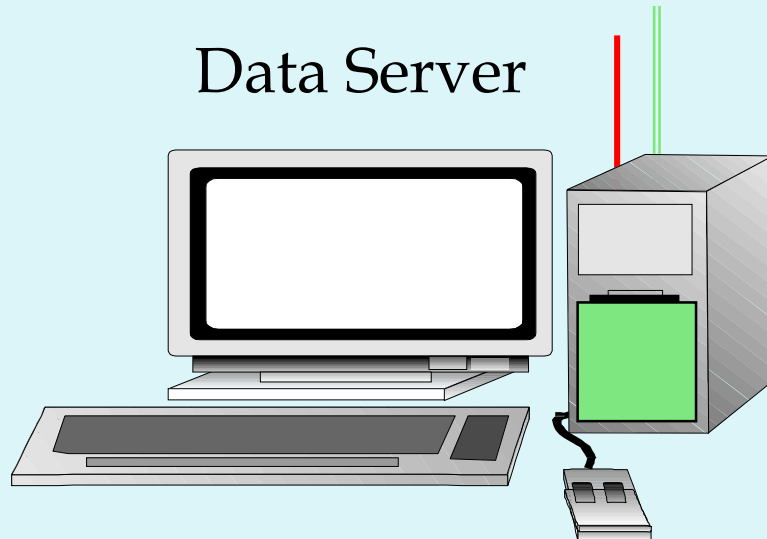
- Client layer
- Data Server Layer

Client layer caters the Human machine interaction. whereas **Data Server Layer** handles most of the process data control activities. The data servers communicate with devices in the field through process controllers i.e. PLCs which are connected to the data servers either directly or via networks or fieldbuses that are proprietary or non-proprietary.

WebAccess Networking

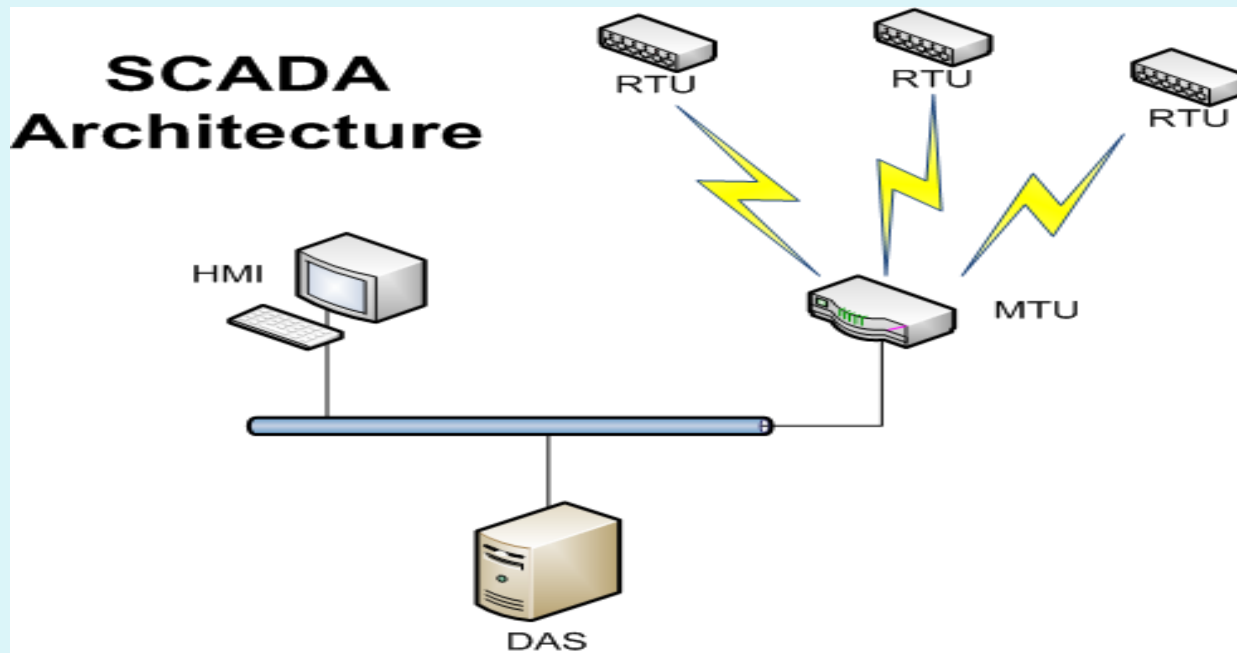


Data servers are connected to each other and to client stations via an Ethernet LAN or WAN. The data servers and client stations are NT platforms but for many products the client stations may also be Windows machines.



Sub Systems of SCADA

- Human Machine Interface (HMI)
- Remote Terminal Units (RTUs)
- Programmable Logic Controller (PLCs)
- Communication Infrastructure

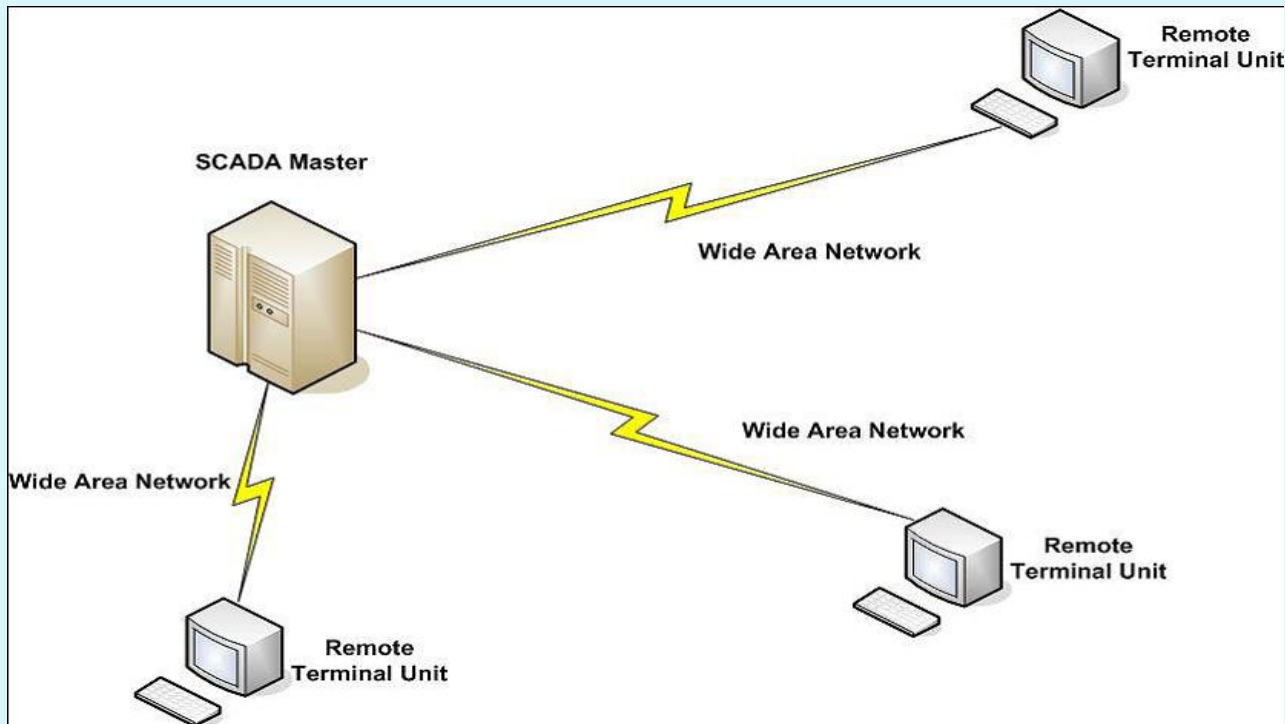


■ A **Human Machine Interface** or **HMI** is the apparatus which presents process data graphically to a human operator, and through this, the human operator monitors and controls the process.

The operator can see a schematic representation of the plant being controlled.

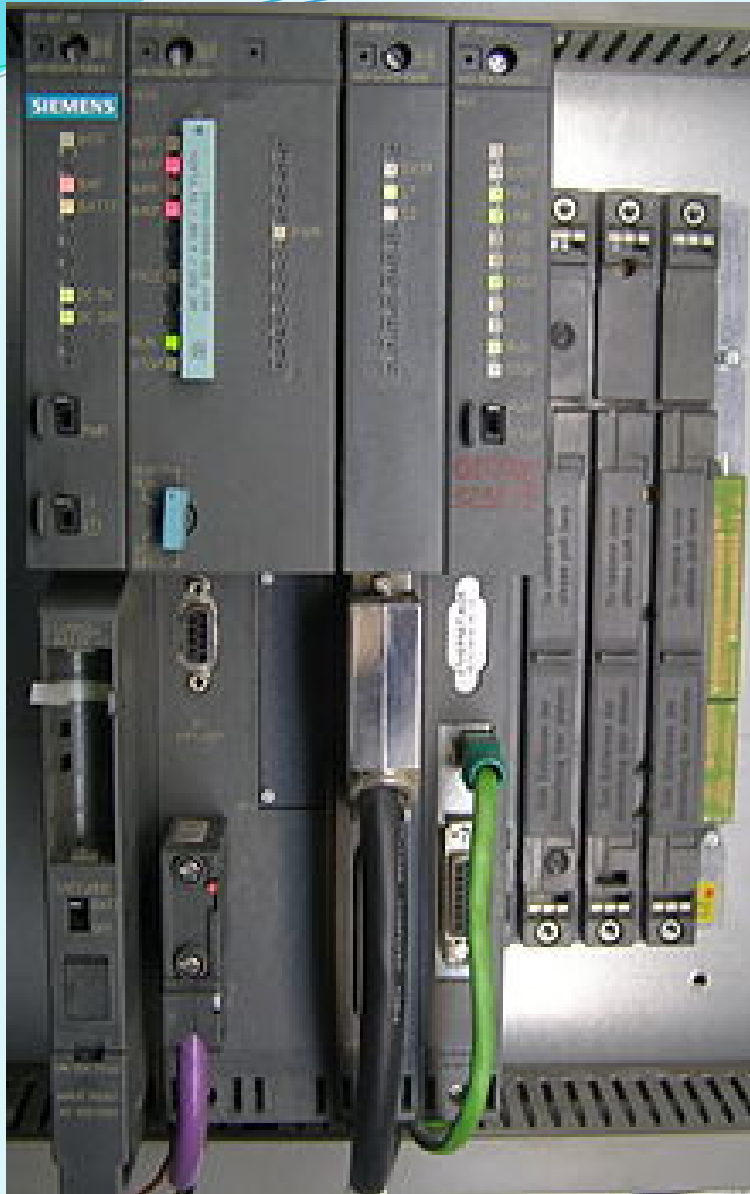


Remote Terminal Units (RTUs) are basically nodes of distributed SCADA based systems used in remote locations. connecting to sensors in the process, converting sensor signals to digital data and sending digital data to the supervisory system



Programmable Logic Controllers (PLCs).

PLCs are computer-based solid-state devices that control industrial equipment and processes. While PLCs are control system components used throughout SCADA and DCS systems, they are often the primary components in smaller control system configurations. PLCs are used extensively in almost all industrial processes.



- Programmable Logic Controllers (PLCs) used as field devices because they are more economical, versatile, flexible, and configurable than special-purpose RTUs.
- Communication infrastructure connecting the supervisory system to the Remote Terminal units.



Power supply sources

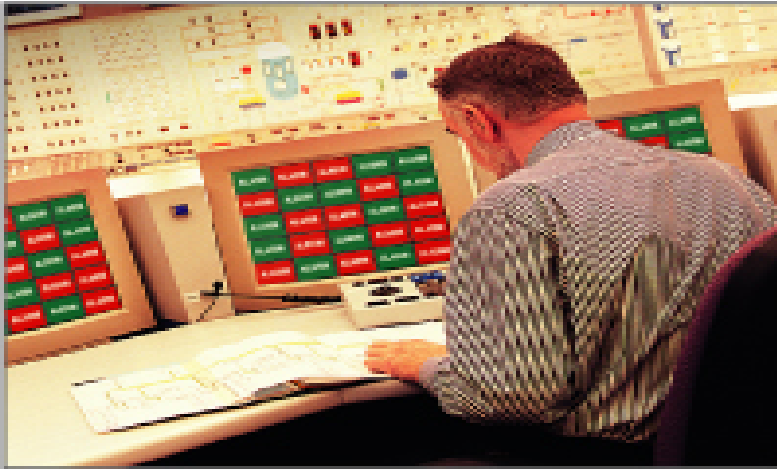
- The preferred power supply for SCADA systems is the direct current (DC) station battery system. DC Station battery systems can be inherently more reliable than alternating current (AC) uninterruptible power supply (UPS) systems.
- PLCs are available with DC power supplies rated at voltages between 24 VDC and 125 VDC, and DC-DC converters are available to supply lower voltage components from higher voltage systems.



Features of SCADA

Real Time & Historical Trend :

If your batch fails or plant trips, you can simply go to historical trend data & do the analysis. You can have better look on the parameters through the trend.



BEFORE

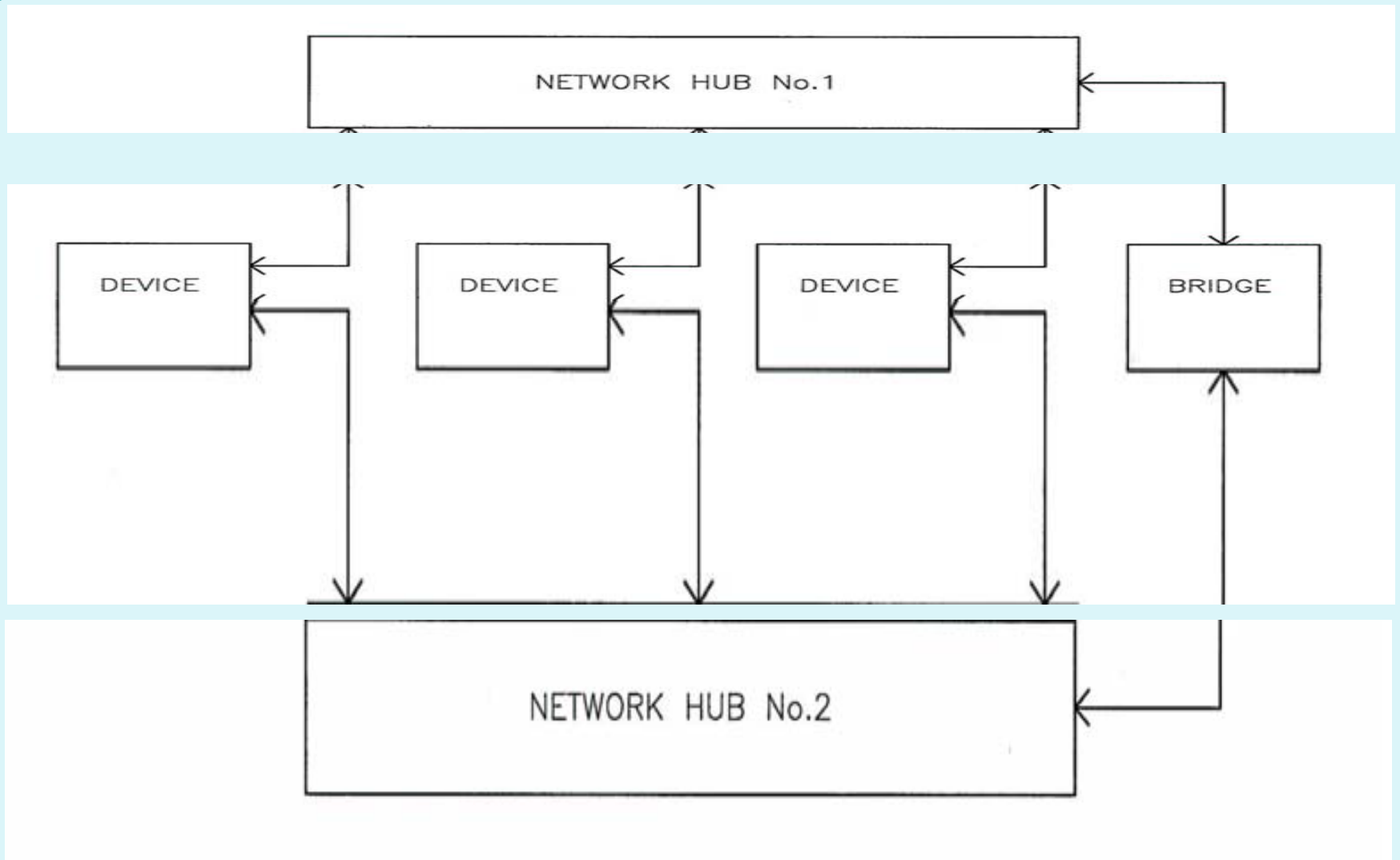


AFTER

Alarms

Alarms have a very critical role in automation. Generally we have alarm states for each inputs/outputs security. You can allocate certain facilities or features to the operator, process people, engineering dept. & maintenance dept

Network redundancy



Fully redundant network

Application of SCADA system

- Water Management Systems.
- Electric Power.
- Traffic Signals.
- Environmental Control Systems.
- Manufacturing Systems.
- Transmission, Generation, Distribution system.
- Mining plants,
- water and electrical utility installations to oil gas plants.

Electric power generation, transmission and distribution:

Electric utilities detect current flow and line voltage, to monitor the operation of circuit breakers, and to take sections of the power grid online or offline.



Buildings, facilities and environments:

Facility managers use SCADA to control HVAC, refrigeration units, lighting and entry systems.

Manufacturing: manage parts inventories for just-in-time manufacturing, regulate industrial automation and robots, and monitor process and quality control.

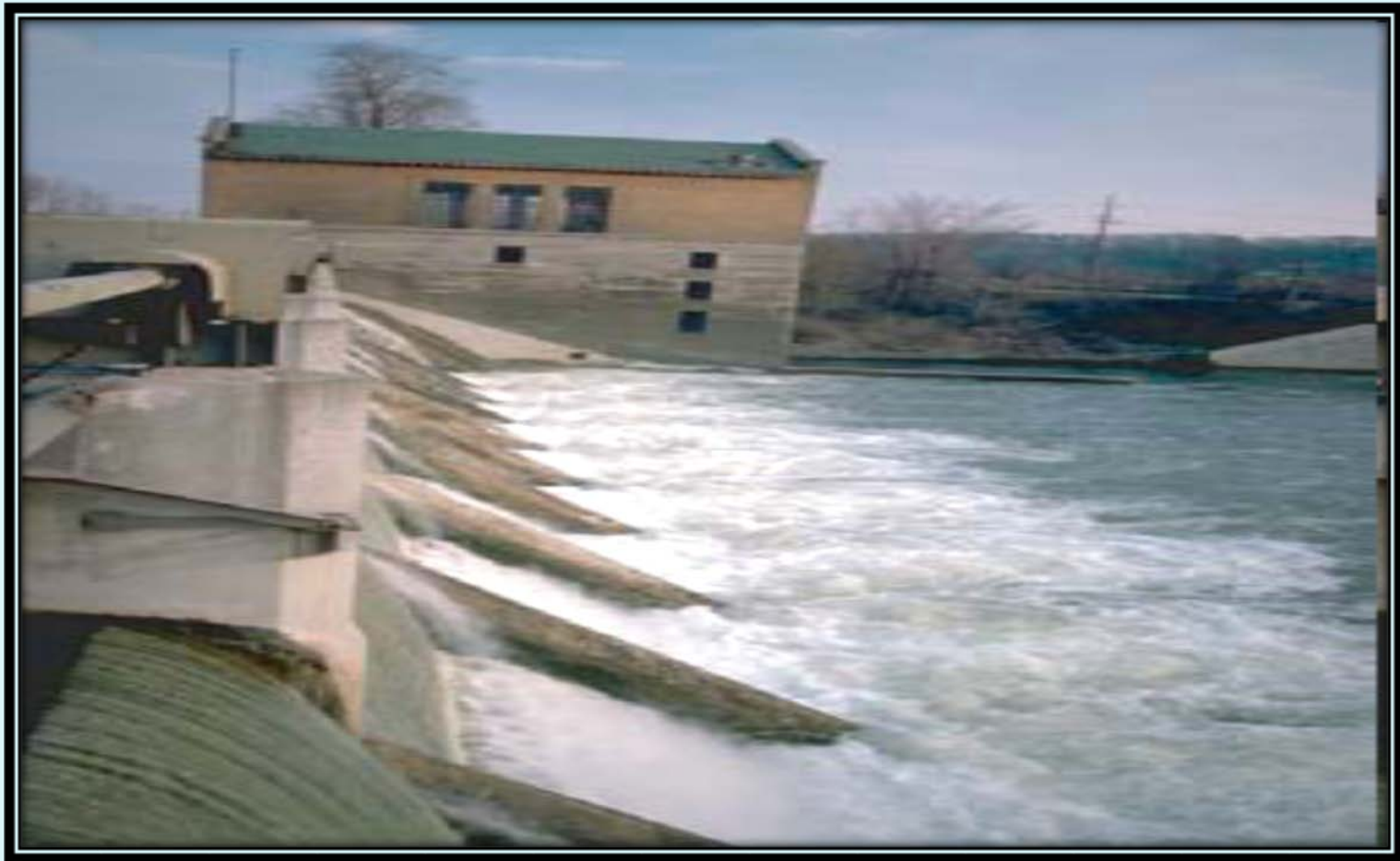


Water and sewage: State and municipal water utilities use SCADA to monitor and regulate water flow, reservoir levels, pipe pressure and other factors.



SCADA Control

Water and sewage: State and municipal water utilities use SCADA to monitor and regulate water flow, reservoir levels, pipe pressure and other factors.





Electric power generation, transmission and distribution: Electric utilities detect current flow and line voltage, to monitor the operation of circuit breakers, and to take sections of the power grid online or offline.

Manufacturing: manage parts inventories for just-in-time manufacturing, regulate industrial automation and robots, and monitor process and quality control.



Supervisory Control & Data Acquisition Software

Features of typical SCADA software

- ▶ Real-time and Historical trending
- ▶ Dynamic process graphic
- ▶ Alarms
- ▶ Security
- ▶ Device connectivity
- ▶ Database connectivity

Advantages Of SCADA systems

- Easily programmed or reprogrammed.
- Easy maintained (self diagnostic).
- Capability to do arithmetic function.
- The ability to communicate with other controller or a master host computer.

SCADA SECURITY

- Software security & reliability criteria.
- Environmental threats.
- Electronic threats.





Thanks & Have a
Good Luck